

New Jersey's Ambient Ground Water Quality Monitoring Network

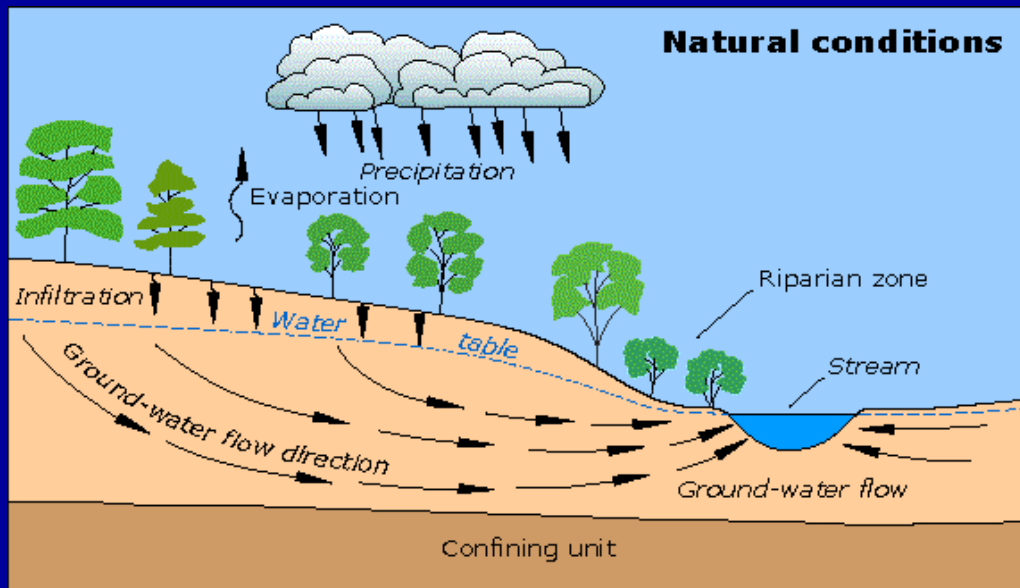
New Jersey Water Monitoring Council Meeting 9/24/04



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Ground Water Quality

Major Controls



<http://wwwga.usgs.gov/edu/earthgwdecline.html>

- Natural conditions
 - water-rock interactions
- Non-point sources
 - land use
- Point Sources
 - > 6000 in NJ

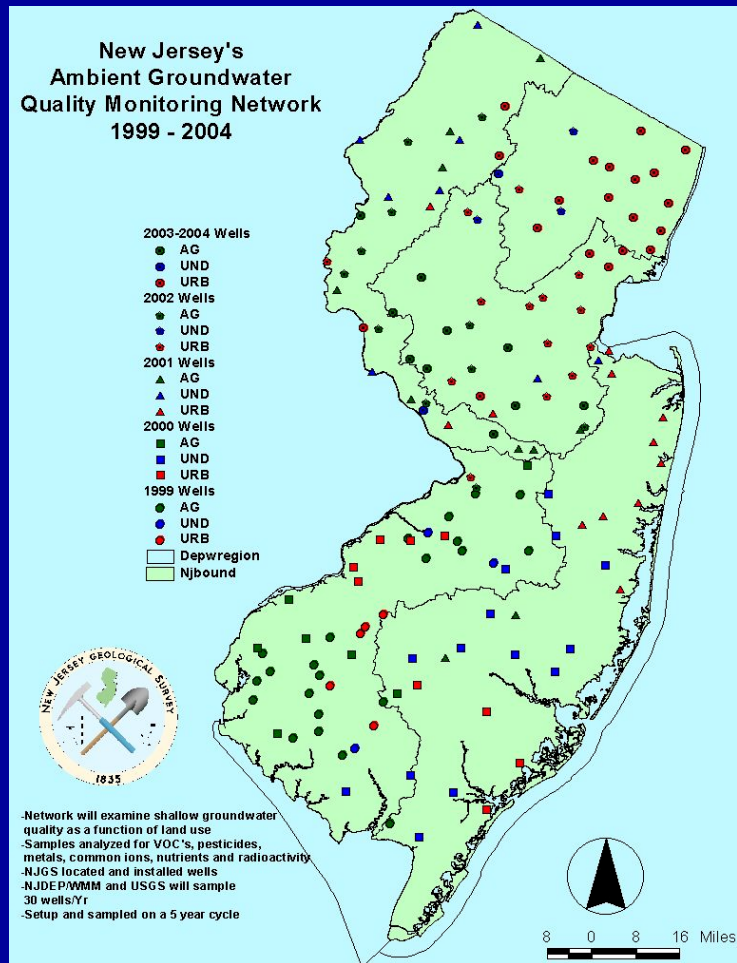
Topics Presented

- Overview
 - GW Network Program History - Goals
 - Present Network Background
 - Physical and Chemical Parameters analyzed
 - Network Data Availability
- New Network Design
- Status of Shallow GW quality in Coastal Plain of NJ
 - Lower Delaware and Atlantic Coastal Water Regions

GW Network Program History - Goals

- Goal 1986 to 1995: Determine status of natural ground-water quality as a function of geology (major aquifers) in New Jersey.
- Goal 1996 to 1997: Determine status of shallow ground water quality near receiving surface waters (Rancocas Creek and Toms River).
- Goal 1998: Redesign Network and Assist NAWQA in Western Piedmont.
- Goal 1999 to present: Establish and sample a 150 well permanent statewide network.

Network Background (present)



- NJDEP/USGS Cooperative Network
- Present annual funding: NJDEP \$58,700 with \$58,700 USGS match
- NJDEP and USGS sample 15 wells each annually
- Samples analyzed at USGS Laboratory in Denver Colorado

Parameters Analyzed



- Field parameters
- Major ions
- Trace elements (metals)
- VOCs
- Pesticides
- Radioactivity (gross alpha)

USGS National Water Quality Laboratory

Gas chromatographic mass spectrometer used to determining presence and concentrations of volatile organic compounds.

Data Availability

- NJDEP Imap
 - <http://blanco.dep.state.nj.us/website/njgsimap4/viewer.htm>
- NJDEP reports
 - NJGS Geological Survey Reports and Informational Circulars
 - 305b Integrated Report
- USGS - NWIS
 - <http://waterdata.usgs.gov/nwis/>
- USGS- Annual Water Reports

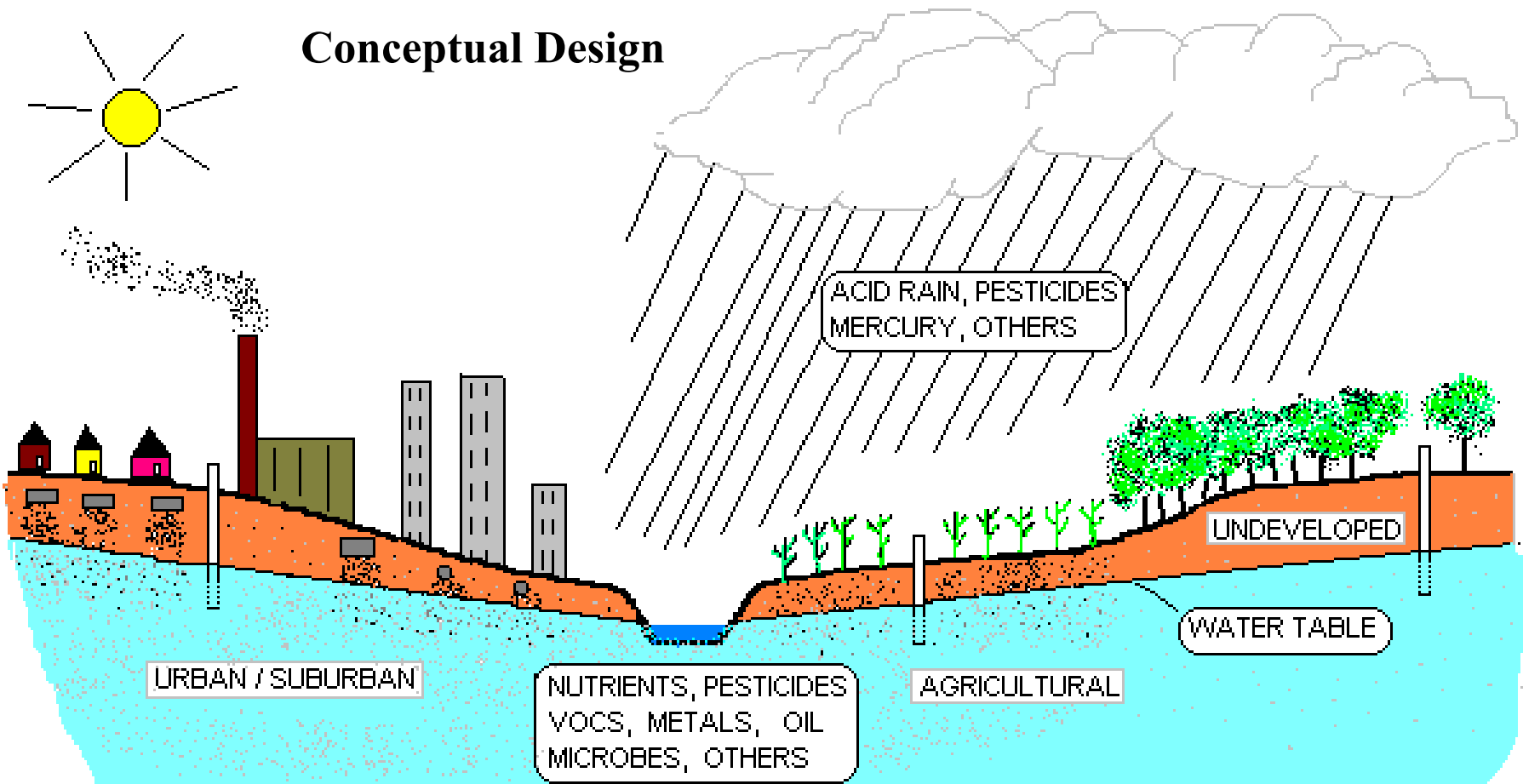
	Agriculture			Urban			Undeveloped		
	Min.	Med.	Max.	Min.	Med.	Max.	Min.	Med.	Max.
T (Celsius)	12	16	22.5	15	18.2	29	12	14.5	18
DO (mg/L)	<0.2	6.4	10.5	<0.2	2.1	10	<0.2	4.6	9.3
pH	4	5.1	7.9	3.8	4.9	7.8	3.7	4.7	6
TDS (mg/L)	35	194	690	57	161	816	15	27	152

New Network Design (1998)

Committee decided the network must be designed to do the following:

- **Evaluate the status of ground-water quality**
- **Evaluate ground-water quality trends**
- *Evaluate* **contaminant sources**
- *Identify* **emerging issues**

Conceptual Design

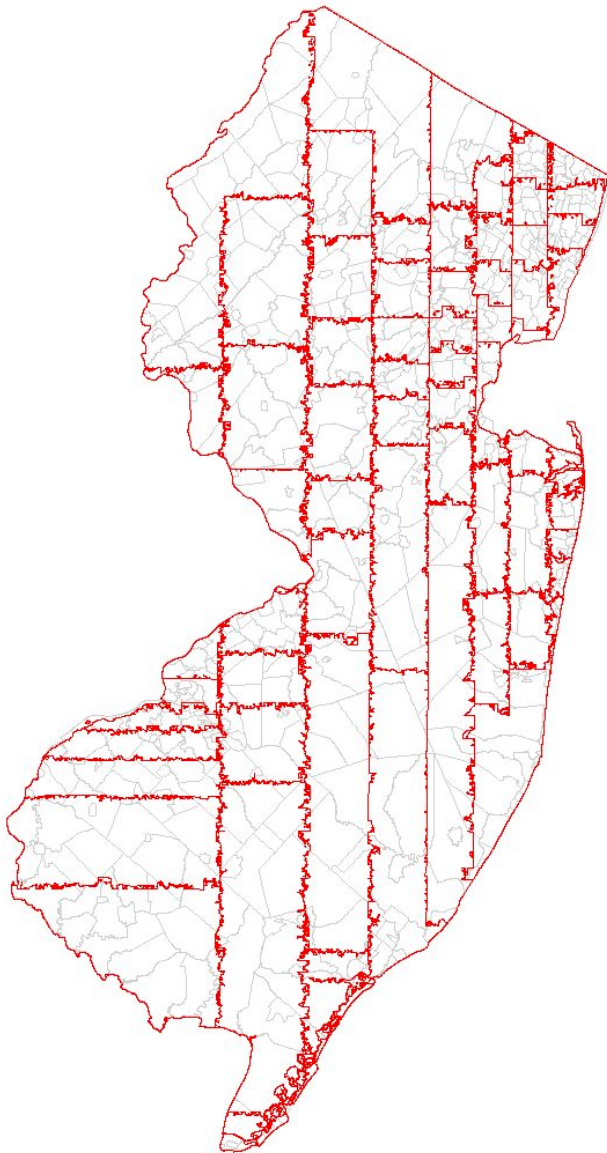


Use shallow wells to evaluate non-point source pollution groundwater in NJ.

Stratified as a function of Urban (60 wells), Agricultural (60 wells) and Undeveloped (30 wells) land uses.

Network consists of 150 randomly placed shallow ground-water wells. Sampled 30 per year with a 5 year network cycle frequency.

Well Site Selection - Urban Land Use Cells



- 60 cells statewide
- Equal area of urban land use in each
- One well site selected in each cell
- Aerial photographs and land use maps used
- Site visits to establish land use and access issues most important for proper site selection.

Urban/Suburban (60 Wells)



Well 30, Elmer, Salem County

Non Point Discharges

- Fertilizers and Pesticides
- Septic Discharge
- Leaky Sewers
- Automobiles
- Volatile Organic Compounds ex: MTBE
- Others

Agricultural (60 Wells)

Non Point Discharges



Well 54, Hammonton, Atlantic County

- Pesticides
- Nutrients
- Liming Agents
- Mobilized Metals
ex:radium
- Others

Undeveloped (30 Wells)

Non Point Discharges



Well 16, Lebanon State Forest,
Burlington County

Atmospheric Sources

- **Metals ex:Hg**
- **Nitrate**
- **Volatile Organic Compounds: MTBE**
- **Pesticides**
- **Acid Rain**

Ambient Ground Water Quality Monitoring Network Conceptual (1998) and Actual (2004)

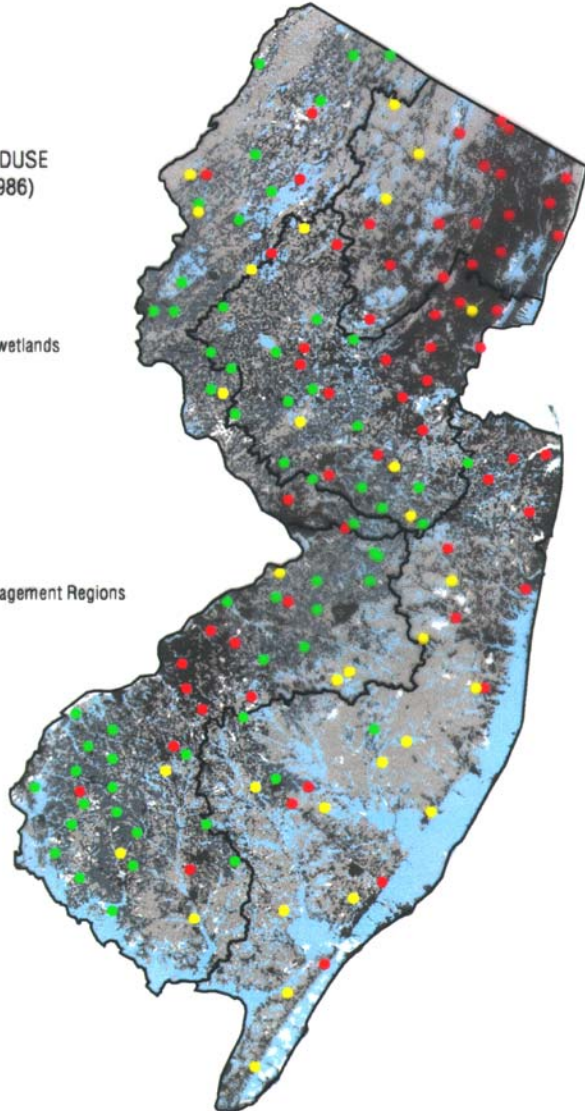
GENERALIZED LANDUSE
IN NEW JERSEY (1986)

- Urban
- Agricultural
- Undeveloped
- Water bodies and wetlands

Selected Well Sites

- Urban
- Agricultural
- Undeveloped

Watershed Management Regions



New Jersey's
Ambient Groundwater
Quality Monitoring Network
1999 - 2004

2003-2004 Wells

- AG
- UND
- URB

2002 Wells

- AG
- UND
- URB

2001 Wells

- AG
- UND
- URB

2000 Wells

- AG
- UND
- URB

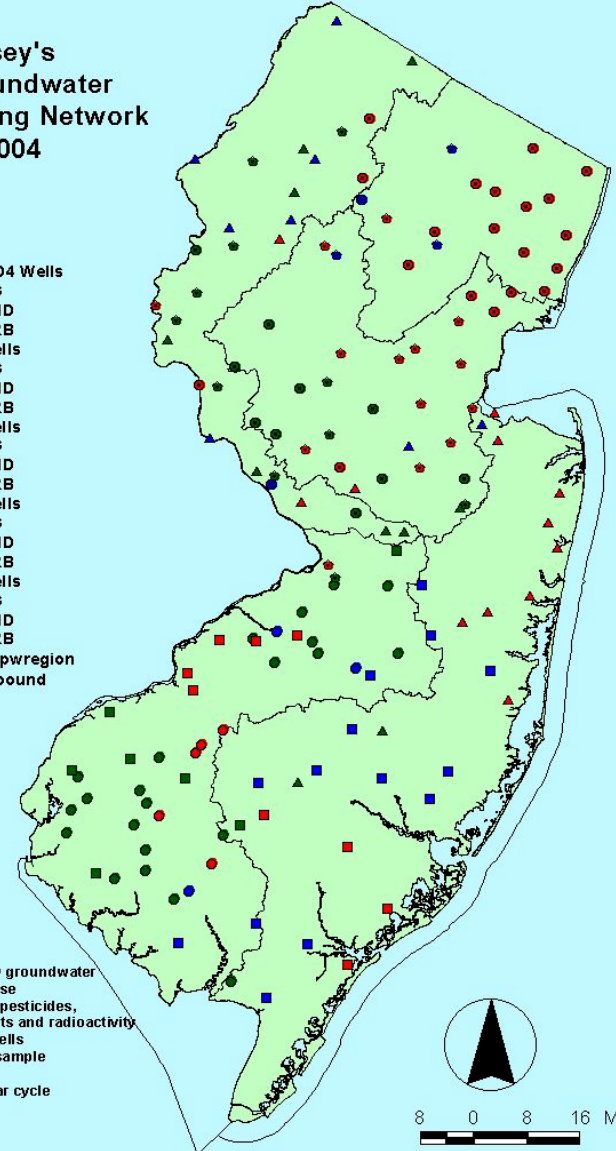
1999 Wells

- AG
- UND
- URB

- Depwregion
- Njbound

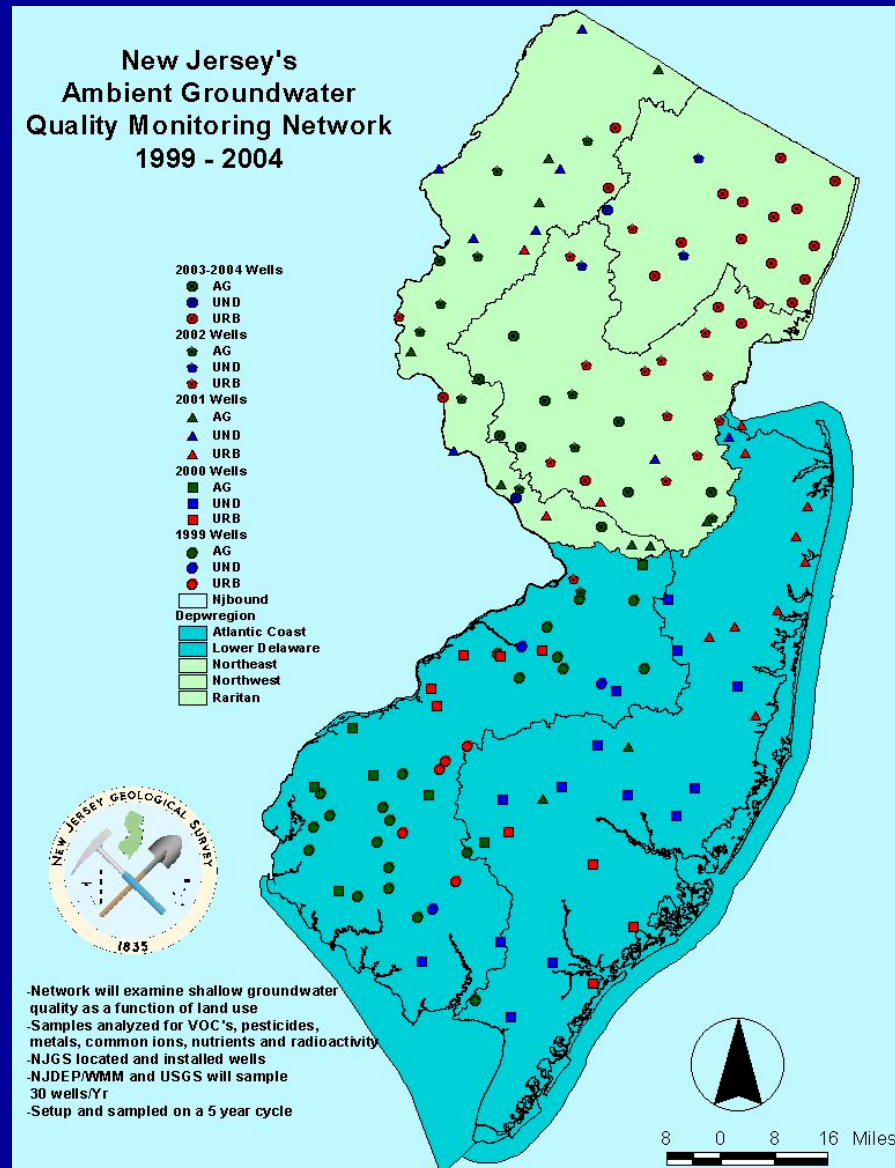


- Network will examine shallow groundwater quality as a function of land use
- Samples analyzed for VOC's, pesticides, metals, common ions, nutrients and radioactivity
- NJGS located and installed wells
- NJDEP/WMM and USGS will sample 30 wells/Yr
- Setup and sampled on a 5 year cycle



8 0 8 16 Miles

1st round Water Quality Status from 71 Wells in Lower Delaware and Atlantic Coastal Water Regions 1999 – 2001



General Water Quality Parameters

	n = 31			n = 22			n = 18		
	Agriculture			Urban			Undeveloped		
	Min.	Med.	Max.	Min.	Med.	Max.	Min.	Med.	Max.
T (Celsius)	12	16	22.5	15	18.2 ☀	29	12	14.5	18
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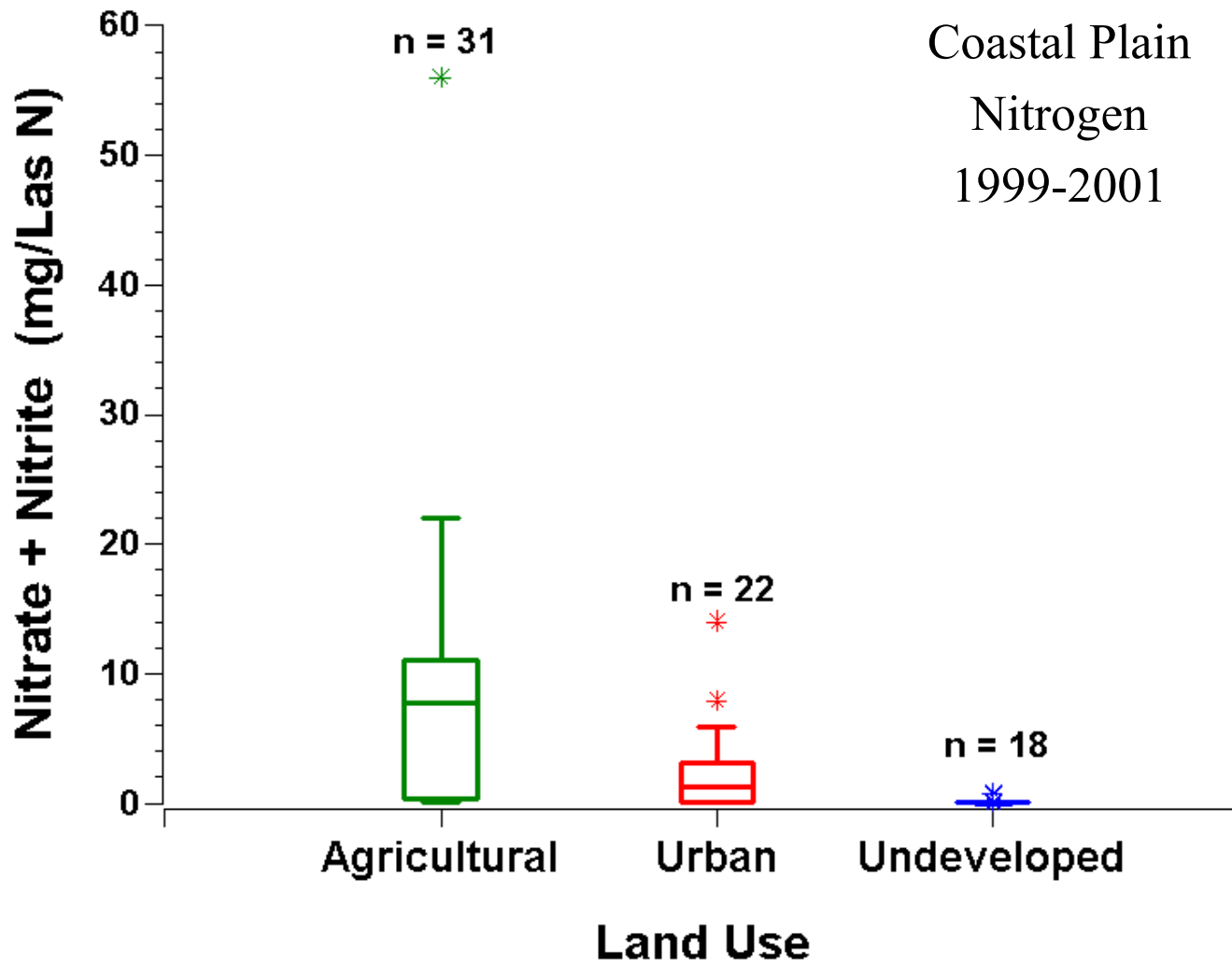
Temperature: may be related to impervious surfaces

Dissolved Oxygen: DOC ~ same in all land uses,
chemical? temperature variations?



pH: liming agents?

TDS: road salt, fertilizers and liming agents

Nitrogen



Trace Elements

Detectable Trace Elements	N	Number of Wells in which Trace Elements detected by Land Use			Maximum Value Detected ug/L	NJ Drinking Water MCL ug/L 1996
		Agricultural (N=31)	Urban (N=22)	Undeveloped (N=18)		
Arsenic 	70	9	5	7	112	50 ¹
Barium	70	30	22	18	1180	2000
Cadmium 	69	6	7	1	16	5
Chromium	69	13	10	4	3.6	100
Copper	70	20	14	7	38	1300AL
Lead	70	8	8	2	11	15AL
Mercury	70	2	1	0	1.7	2
Selenium	70	13	10	4	13.1	50
Total Detections	--	101	77	43	--	--

Arsenic: highest values 112 and 42 ug/l are as associated with water with low DO, high Fe and relatively high DOC.

Cadmium: The highest concentration of 16 ug/L is from a shallow well in the Kirkwood-Cohansey Aquifer in an agricultural land use area. The second, third and forth highest Cd concentrations of 4, 3.4 and 1.8 ug/L are from wells in the Marshalltown Formation in agricultural, urban and urban land uses respectively






VOC


Detectable Volatile Organic Compounds	N	Frequency of Detection by Land Use			Maximum Value Detected ug/L	NJ Drinking Water MCL ug/L 1996
		Agricultural (N=31)	Urban (N=22)	Undeveloped (N=18)		
MTBE ☀	71	4	10	1	47.1	70
1,1,1-Trichloroethane	71	1	0	0	E 0.0555	30
1,2, Dichloropropane	71	1	0	0	0.3	5
Acetone	8	1	0	0	E 1.93	NMCL
Benzene-1,2,4-Trimethyl	8	1	0	0	E 0.027	NMCL
Benzene-1,4-Dichloro	71	1	0	0	E 0.00703	NMCL
Chloroform ☀	71	7	8	9	0.395	100 ¹
cis-1,2-Dichloroethene	71	0	1	0	0.2	NMCL
Dichlorobromomethane	71	1	0	0	0.3	NMCL
Dichlorodifluoromethane	71	1	0	0	E 0.3	NMCL
Diisopropylether	71	0	1	0	6.3	NMCL
Methylethylketone	8	1	0	0	3	NMCL
Styrene	71	1	0	0	E 0.01	100
tert-pentylmethylether	71	0	1	0	0.105	NMCL
Tetrachloroethylene	71	4	3	0	0.487	1
Toluene	71	4	2	1	0.2	1,000
Trichloroethylene	71	1	0	0	E 0.0382	1
Total Detections	--	29	26	11	--	--

MTBE: Reformulated gasoline

Chloroform: ubiquitous environmental contaminant, atmospheric deposition, septics?

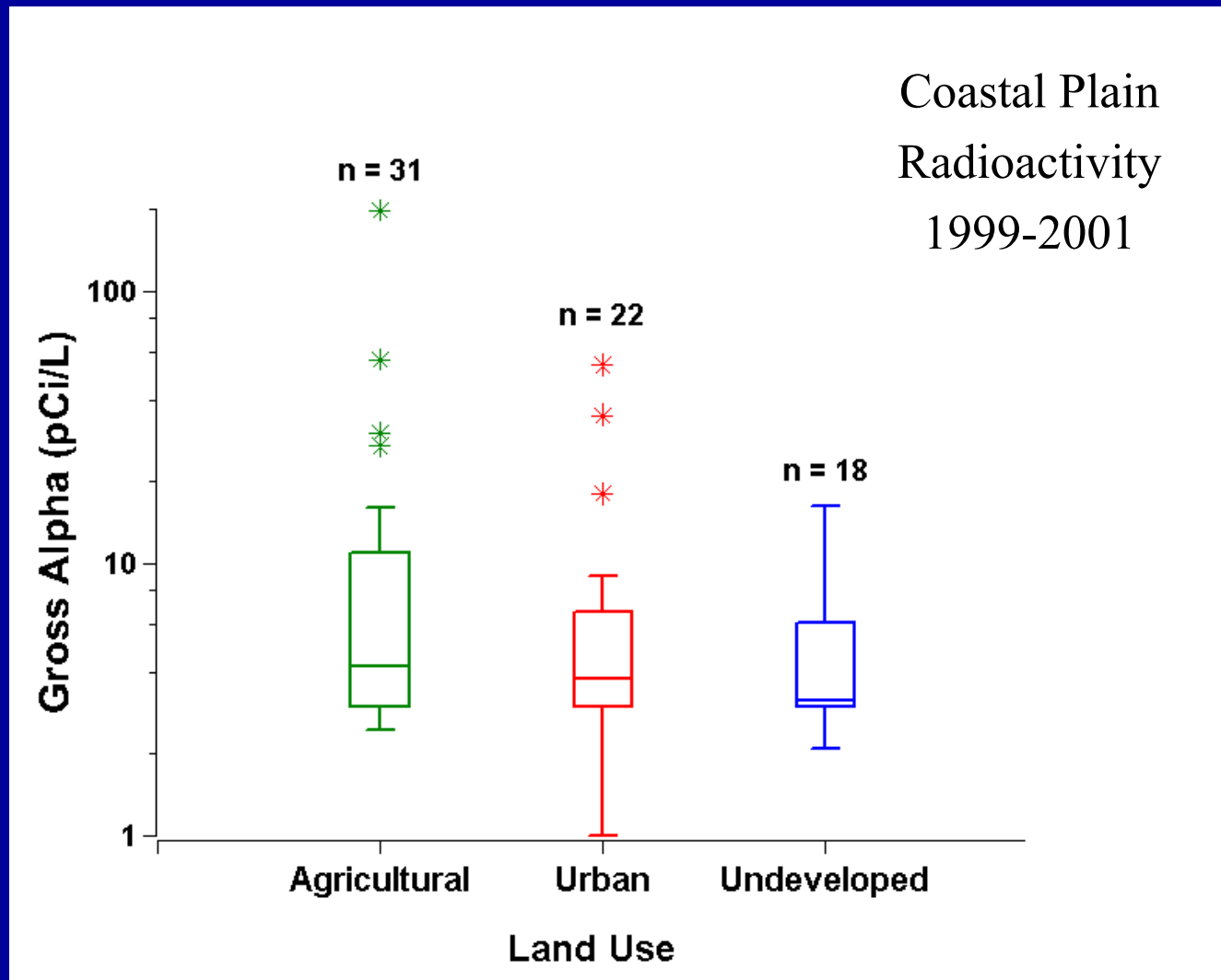
Pesticides

Detectable Pesticide Compounds	N	Number of Wells in which Compound(s) detected by Land Use			Maximum Value Detected ug/L	NJ Drinking Water MCL ug/L 1996
		Agricultural (N=31)	Urban (N=22)	Undeveloped (N=18)		
Alachlor	71	3	0	0	0.011	2
Atrazine 	71	14	5	0	0.299	3
Carbaryl	71	5	1	0	E.47	NMCL
Carbofuran	71	4	0	0	E.0634	40
Dacthal	71	2	0	0	E	NMCL
DCPA	71	1	0	0	E.0017	NMCL
Deethylatrazine 	71	15	4	0	E.206	NMCL
Diazinon	71	1	0	1	E.003	NMCL
Dieldrin	71	2	2	0	0.491	NMCL
EPTC	71	1	0	0	0.031	NMCL
Malathion	71	0	0	1	E.0037	NMCL
Metolachlor 	71	16	3	0	1.17	NMCL
Metribuzin	71	2	0	0	0.0128	NMCL
Molinate	71	1	0	0	0.0126	NMCL
Napropamide	71	2	0	0	0.0206	NMCL
Pendimethalin	71	1	0	0	0.0119	NMCL
P, P'-DDE	71	4	1	1	E.0026	NMCL
Pebulate	71	0	1	0	0.0194	NMCL
Prometon 	71	4	7	0	0.426	NMCL
Propanil	71	0	0	1	E.0034	NMCL
Tebuthiuron	71	1	1	0	0.138	NMCL
Terbacil	71	3	0	0	E.683	NMCL
Trifluralin	71	2	0	0	E.0031	NMCL
Simazine 	71	10	3	0	0.743	4
Total Detections	--	94	27	4	--	--

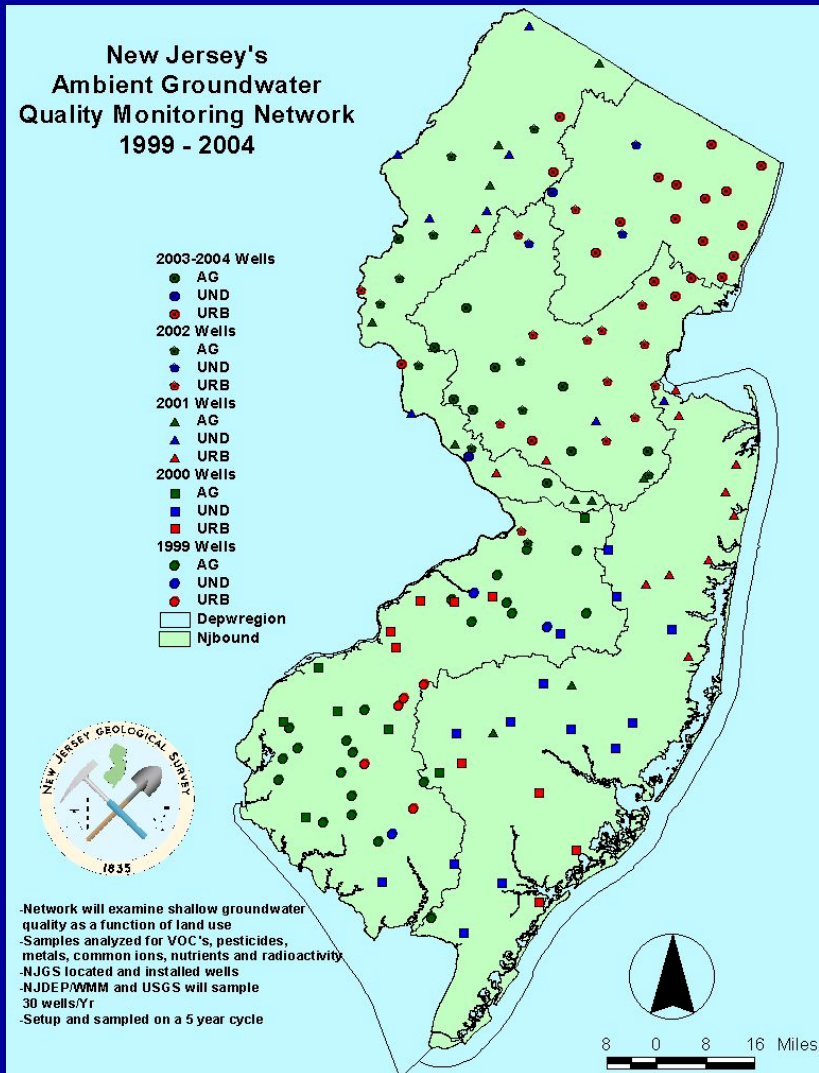
 Herbicides: controls the growth of weeds and grasses

 Metaboite of Atrazine

Radioactivity



1st comprehensive status report - 2005



- Data from all 150 wells sampled in 1st round will be available in early 2005.
 - Data analysis by region and land use
 - Comparison with NJDEP DW and GW standards.
 - Interpretation of results to define contaminant sources.